National Aeronautics and Space Administration



Innovative Partnerships Program

Accomplishments: 2009-2010

at NASA's Kennedy Space Center













Innovative Partnerships Program



As we reflect on the past 2 years with this Accomplishments Report, you will see that this has been a very active and productive period of technology development partnerships and technology transfer for the Innovative Partnerships Program (IPP) at NASA's Kennedy Space Center.

Through programs such as our Seed Fund, Innovation Fund, and Small Business Innovation Research (SBIR) program, we have helped to advance the development and demonstration of technologies across a wide spectrum of disciplines—from technologies for lunar and Mars applications to smart coatings for corrosion detection and prevention. We also transferred NASAdeveloped technology to industry partners in areas such as environmental remediation, pollution prevention, and diagnostics for nuclear power plants.

However, this has also been a period of significant change for IPP, and more changes are coming. As announced in the President's fiscal year 2011 budget request, all elements of IPP are being integrated into NASA's newly established Office of the Chief Technologist (OCT), which has the broad mission of enabling new approaches to achieving future missions not feasible today. Similar to the IPP Office, OCT will complement the technology development activities of NASA's mission directorates and continue to facilitate the transfer of NASA-developed technology for commercial application and other public benefit, while addressing some of the global challenges we face as a nation.

President John F. Kennedy once said that "change is the law of life, and those who look only to the past or present are certain to miss the future." It is in this spirit that we look forward to the changes that will ultimately lead to new opportunities for the OCT and for the agency.

I hope that you enjoy this report and continue to support NASA's technology transfer and partnerships program as it evolves under its new organization.

David Makufka

Innovative Partnerships Program Lead NASA's Kennedy Space Center



About Kennedy's Innovative Partnerships Program



Kennedy's IPP team (left to right): seated are Hetal Shah and Joni Richards; standing are Megan Victor, Carol Dunn, Jennifer Van Pelt, Pasquale Ferrari, David Makufka, Jim Nichols, Alexis Hongamen, Lewis Parrish, and Jeff Kohler. Also pictured (far right) is Kennedy's patent counsel, Randy Heald.

The mission of the Innovative Partnerships Program is to provide leveraged technology alternatives for mission directorates, programs, and projects through joint partnerships with industry, academia, government agencies, and national laboratories. As outlined in this accomplishments summary, the IPP at NASA's Kennedy Space Center achieves this mission via two interdependent goals:

- Infusion: Bringing external technologies and expertise into Kennedy to benefit NASA missions, programs, and projects
- Technology Transfer: Spinning out space program technologies to increase the benefits for the nation's economy and humanity

To find out more about how Kennedy's IPP achieves its goals, visit us online: http://technology.ksc.nasa.gov

In achieving these goals, we undertake multiple efforts designed to foster the development and use of innovation. These efforts include:

- · Providing resources needed to accelerate the development of innovations that benefit not only NASA but also the greater commercial marketplace
- Fostering partnerships that allow Kennedy to achieve NASA goals more efficiently by leveraging the technologies, expertise, and resources of industry, academia, and other government agencies
- Helping secure and gaining recognition for NASA's intellectual property to protect and increase the strategic value of this national asset
- Making Kennedy technologies available to external organizations and forming the agreements that enable their non-NASA use

Read on to learn about what IPP has accomplished during the past 2 years of performing this work.

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Infusion

Technology infusion is the process of strategically binding technical needs and potential solutions. Through investments and partnerships, IPP provides a pathway to transition innovative solutions from their originating source to the targeted challenges within NASA's programs and projects.

Innovation Investments

To help ensure that NASA missions, programs, and projects have the technologies they need to achieve their scientific and exploration goals, IPP invests in technology development via several programs.

Partnership Seed Fund: **Bridging Technical Gaps**

IPP's Partnership Seed Fund provides "bridge funding" that enables larger project partnerships and development efforts where all participants share the costs, risks, benefits, and outcomes. Project awards from IPP at NASA headquarters range from \$100,000 up to \$250,000. The program also requires matching funds from the external partner and support from at least one NASA program or project. At Kennedy, the funding has launched numerous projects that have tested new innovations and advanced technology readiness levels (TRLs). Notable 2009-2010 Seed Fund successes are summarized below.

Smart Coatings Control Corrosion at Launch Pads

A Seed Fund collaboration between Kennedy, PPG Industries, and the University of Texas Health Science Center produced formulations for microcapsule technology for "smart coatings" to detect and control corrosion in carbon steel that will be prevalent in new launch pad structures and support equipment. Like pills that release their contents when exposed to stomach acid, microcapsules for smart coatings are designed to release their contents in response to certain pH levels caused by corrosion.

Vegetable Production System Employs High-Tech LED Arrays

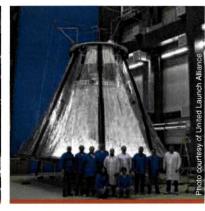
New light-emitting diode (LED) arrays for collapsible plant growth chambers were the focus of research into a system to produce fresh vegetables for crews on long-duration missions. The new LED technology is expected to reduce overall volume and mass while doubling light output. Collaborators at Kennedy and Orbital Technologies Corp. also tested capillary rooting mat concepts and conducted vibration and acoustic hardware tests. Also planned are tests with lettuce and radish plants to assess chamber performance and yields. These innovations had their origins in the Small Business Innovation Research program (see pages 8-9).

Technology Demonstrations at Lunar Analog Site

Researchers tested in situ resource utilization (ISRU) and human robotics systems (HRS) technologies and methods, thanks to a collaboration involving the ISRU and HRS project teams at Kennedy, NASA's Johnson Space Center (with expertise from NASA's Glenn Research Center), and the Pacific International Space Center for Exploration Systems (PISCES) at the University of Hawai'i-Hilo. The field demonstrations helped researchers understand how the robotics systems behave outside the lab.





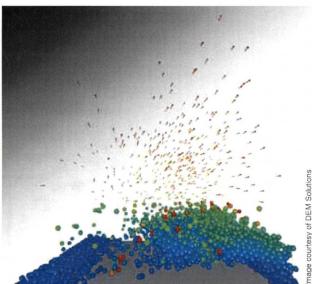


Sun-Shield to Enhance Extended Space Missions

Researchers at Kennedy partnered with United Launch Alliance, ILC Dover Corp., and NASA's Glenn Research Center on early-stage development of a space-based, deployable sun-shielding device to support long-duration in-space propellant storage. The Seed Fund award allowed researchers to work on technology design, development, and testing as well as risk analysis of the shield, materials, components, and assembly. The collaborative effort was critical to efficient maturation of the sun shield.

Answering Questions about Moon Dust

A partnership between Kennedy and DEM Solutions yielded improved modeling software that will enhance dust-mitigation technologies being developed in Kennedy's Electrostatics & Surface Physics Laboratory. The software program provides accurate modeling of lunar dust and regolith, reducing the need for extensive field testing for new technologies. According to DEM, the project also spawned innovations resulting in advanced features that its current customers now use for modeling cohesive materials and particle-fluid systems.



Device Monitors Space-Based Radiation Damage to DNA

Researchers further developed the design of a miniaturized device to monitor damage to DNA in real time, advancing our understanding of the effects of radiation exposure in space. The microfluidic system will allow for rapid and continuous genetic DNA sample analysis in a small package that can be flown on a nanosatellite. This collaboration by Kennedy, NASA's Ames Research Center, and Louisiana Tech University has implications for several mission directorates.



Detecting Electrical Wire Faults

Kennedy and Thermax have formed a partnership that is enabling the space agency to use the company's recently developed next-generation wire model. Thermax's model includes embedded insulation damage detection. This collaboration raises the TRL of the In Situ Wire Damage Detection System to a higher level by enabling the manufacture of real parts that can be tested in a relative and real environment.





Innovation Fund: Supporting Early-Stage Research

IPP's NASA Innovation Fund supports innovators with revolutionary, yet early-stage, novel technologies and new processes. Of particular interest are innovations with the potential to address other national and global challenges. With selections made in consultation with the agency's Office of the Chief Engineer, projects generally are those that are too early in their development to compete for support from other NASA funding sources. The two projects summarized below were funded in 2009, while four more projects received funding in late 2010, bringing IPP's total Innovation Fund investment at Kennedy to \$358,000.

Dust Tolerant Intelligent Electrical Connection System

This project investigated techniques to mitigate lunar dust intrusion and accumulation on reusable electrical connectors. Researchers also explored non-intrusive methods to detect circuit faults and automatically reroute signals while a vehicle or lunar surface system equipment is in operation. Such a system not only would benefit NASA lunar and Mars missions but also would assist the military as well as mining and oil and gas exploration operations.

Repair Techniques for Composite Structures

Use of composites in airframes is in demand, but since there is such a wide variety of airframe structures, technicians are hampered in their inspection tool calibration efforts to accurately diagnose damage. In preparation for delivery of Ares V at Kennedy, the center partnered with Marshall Space Flight Center to evaluate current repair technologies; develop and define damage limits for a composite structure; and fabricate, damage, inspect, and repair a composite part.

Internally Funded Projects: Addressing High Priority Needs

Kennedy's IPP funds technology development to address challenges on the center's High-Priority Needs List. In 2009 and 2010, IPP funded 10 projects, contributing more than \$1.6 million toward important research and development (R&D). Below are two examples of these projects.

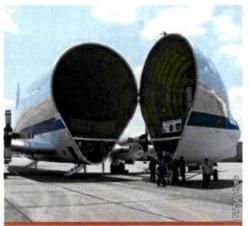
Three-Way Partnership Produces Ice Detection Camera

A remote non-contact ice detection and measurement system is a new component in NASA's toolbox of launch inspection methods for space vehicle programs. The lightweight portable camera system uses near-infrared wavelengths to detect and measure ice thickness as well as to differentiate ice from water. The project, which IPP supported, was a joint effort between Kennedy; the U.S. Army Tank Automotive Research, Development and Engineering Center; and MDA Corporation.

Understanding Cryogenic Fluid Management Technologies

Demonstrating cryogenic fluid management (CFM) technologies is critical for long-duration space missions. Kennedy researchers partnered with a host of industry partners to advance the development of a Cryogenic Orbital Testbed (CRYOTE) to demonstrate a broad array of critical CFM technologies in the space and ground environment. Results will aid in the development of high-efficiency ground operations, lunar surface systems, upper stages, propellant depots, solar thermal and nuclear thermal propulsions, and cryogenic science applications. Partners include United Launch Alliance (ULA), Sierra Lobo Inc., Innovative Engineering Design, and Yetispace Inc.





FAST: Enabling Low-Gravity Testing of Innovations

IPP established FAST—the Facilitated Access to the Space Environment for Technology Development and Training program—to provide opportunities for emerging technologies to perform testing in the space environment simulated aboard parabolic aircraft flights. Zero Gravity Corporation of Las Vegas, Nevada, provides the weightless flights at Ellington Field near NASA's Johnson Space Center.

FAST advances technologies that support NASA's missions but either are not yet mature enough for program adoption or where the funding is not otherwise available for testing, particularly for innovations developed by individuals, small businesses, and universities or other research institutions. The table below summarizes the Kennedy-based innovations tested during 2009 and 2010.

	Technology Project	Kennedy's Partners	FAST Flight Objective
	Magnetic Unjamming and Flow Control of Lunar Soil		Optimize a system to un-jam lunar soil, restoring flow, as well as to act as a valve, stopping flow
	Tribocharged Electrostatic Beneficiation of Lunar Simulant	ASRC Aerospace	Determine the mineral enrichment levels that can be achieved in lunar regolith simulant in low gravity
	Cyclonic Filtering of Pneumatically Conveyed Lunar Regolith Simulant	ASRC Aerospace	Evaluate pneumatic conveying of regolith against gravity as well as filtration of dusty gas
2009	Antimicrobial Materials for Microgravity Environments		Develop a low-impact test stand and standardized test methods to evaluate emerging antimicrobial technologies
	Martian/Lunar Dust Mitigation	ASRC Aerospace	Characterize unit's ability to uniformly disperse and re-disperse charged particles at Martian and lunar gravity levels
	Reduced Gravity Cryo-Tracker Operation	Sierra Lobo Inc.	Demonstrate the device's ability to accurately measure liquid cryogens in reduced-gravity environments
	Pneumatic Mining System under Lunar Gravity and Vacuum	Honeybee Robotics	Assess performance of pneumatic system to "drill," excavate, and transfer regolith over large distances
	Dual Containment Platform for Characterization of Slosh Dynamics in Microgravity	Florida Institute of Technology	Test novel framework designed for experimental characterization of slosh dynamics in microgravity
	Investigation of Resonant Behavior from Propellant Slosh in Spinning On-Orbit Fuel Depots	Embry-Riddle Aeronautical University United Launch Alliance	Perform a scaled microgravity experiment to predict spacecraft attitude stability effects from propellant slosh
2010	Reduced Gravity Testing of One Complete Cycle of an ISRU Pneumatic Regolith Feed System	ASRC Aerospace NASA's Johnson Space Center	Demonstrate system for pneumatically transferring lunar regolith for in situ resource utilization (ISRU)
	Evaluation of Tribocharged Electrostatic Beneficiation of Lunar Simulant in Lunar Gravity	ASRC Aerospace	Test and evaluate the ability of electrostatic beneficiation to enrich mineral ilmenite
	Jet-Induced Cratering of Granular Materials	University of Florida CFO Research Corp.	Test a simulation tool to investigate the material physics and design debris impact mitigation measures

SBIR/STTR: Tapping into Small Business Talent

NASA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, which focus on technological innovation, are vital to the achievement of NASA missions and to the nation's prosperity and security. They contribute to the economic engine that drives hiring and other growth for small businesses—the backbone of the U.S. economy and the future for U.S. technology development.

About the Programs

NASA's SBIR/STTR programs provide opportunities for small, hightechnology companies and research institutions to participate in governmentsponsored R&D efforts in key technology areas. In SBIR contracts, the small business operates independently; STTR contracts involve a research institution partnering with a small business to develop a technology.

The SBIR/STTR programs fund R&D and demonstrations of innovative technologies to fulfill NASA needs. These needs are described in the annual SBIR/STTR solicitation. Innovations receiving SBIR/STTR funding also have significant potential for successful commercialization.

Three-Phase Funding

The SBIR/STTR programs provide funding in three phases:

- Phase 1 SBIR contracts last up to 6 months and provide maximum funding of \$100,000. The duration of STTR Phase 1 contracts is typically 12 months, also with maximum funding of \$100,000.
- Phase 2 SBIR/STTR contracts focus on the development, demonstration, and delivery of the proposed innovation. Contracts usually last for 24 months, with maximum funding of \$750,000, although 4-month extensions with up to \$150,000 additional funding are available through Phase 2 Enhancement (2-E) contracts.
- Phase 3 contracts are funded from sources other than the SBIR/STTR programs and may be awarded without further competition.

Connecting NASA to Small Businesses

The success of the SBIR/STTR program is measured by the extent to which SBIR/STTR technologies are infused into NASA missions via Phase 3 contracts. To help achieve these successes, IPP hosts various events that connect SBIR/STTR companies with personnel from relevant NASA programs and projects.

For example, IPP hosted the Lunar Surface Systems (LSS) and SBIR Technology Workshop in November 2009. This event brought nearly 20 carefully vetted SBIR/STTR companies together with LSS engineers to identify technologies that might address LSS's specific technical needs. The event provided opportunities for companies to present their technologies as well as participate one-on-one focused group meetings with NASA personnel from six field centers. As a result of this event, IPP identified several promising Phase 3 infusion opportunities to benefit NASA's LSS project.

Spotlighting Success: CRG Takes Space-Age Materials to Market

Ohio-based Cornerstone Research Group (CRG), which has been an active participant in NASA's SBIR/ STTR programs for the past 10 years, has significantly contributed to both the space program and the commercial marketplace with its innovative shape memory polymer (SMP). The SMP material can change from rigid to pliable for reshaping and then back to rigid in its new shape upon cooling. This innovative capability makes the polymer useful as a tape-like patch, saving significant time and cost in repairing composite materials and other surfaces. Yet unlike tape, CRG's patches truly "heal" the structure.

CRG originally collaborated with the University of Connecticut under an STTR contract through NASA's Langley Research Center to develop the SMP technology for use in spacebased telescopes. Most recently, CRG worked under an SBIR contract through Kennedy to apply its SMP to space vehicles and the International Space Station.

As CRG continues to work with NASA. the benefits of this work are not limited to the space program. Not only has CRG fed the technology into several Navy programs, but CRG Industries has introduced commercial products that use the SMP to repair race cars and outdoor equipment, such as kayaks.

This success story perfectly illustrates the value that the SBIR/STTR programs have for NASA and the nation.



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2009 Phase 1 Awards

Company (location)	Project	
SBIR		
Advanced Materials Technology Inc. (Florida)	Manufacture of Novel Cryogenic Thermal Protection Materials	
Aspen Aerogels Inc. (Massachusetts)	Hybrid Aerogel-MLI Insulation System for Cryogenic Storage in Space Applications	
Astrobotic Technology Inc. (Pennsylvania)	Lightweight Robotic Excavation	
Atlas Scientific (California)	A Heat Switch for Space Applications	
Ceralink Inc. (New York)	Automated Hybrid Microwave Heating for Lunar Surface Solidification	
Dynamic Structures and Materials LLC (Tennessee)	High Reliability Cryogenic Piezoelectric Valve Actuator	
Honeybee Robotics Ltd. (New York)	Parametric Optimization and Prediction Tool for Lunar Surface Systems Excavation Tasks	
Innosense LLC (California)	Polymer Reinforced, Non-Brittle, Light-Weight Cryogenic Insulation for Reduced Life Cycle Costs	
Materials Technologies Corp. (Connecticut)	Portable Infrared-Based Inspection System (PIRIS)	
Micro Cooling Concepts Inc. (California)	Microplate Heat Exchanger	
Toyon Research Corp. (California)	Metric Tracking of Launch Vehicles	
Ultramet (California)	Aerogel-Filled Foam Core Insulation for Cryogenic Propellant Storage	
Xigen LLC (Maryland)	Novel Ultra-Miniature Lidar Scanner for Launch Range Data Collection	
STTR		
ARIBEX (Utah) with the University of Utah	Three-Dimensional Backscatter X-Ray Imaging System	
LongWave Photonics LLC (Massachusetts) with MIT	Terahertz Quantum Cascade Laser-Based 3D Imaging	
Picometrix LLC (Michigan) with the University of Michigan	Time-Domain Terahertz Reflection Holographic Tomography Non-Destructi Evaluation System	
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2008 Phase 2 Awards

Company (location)	Project			
SBIR				
Adherent Technologies Inc. (New Mexico)	Dust Mitigation for the Lunar Surface			
Aeronix Inc. (Florida)	Radiation Tolerant 802.16 Wireless Network			
Aspen Aerogels Inc. (Massachusetts)	Lightweight Non-Compacting Aerogel Insulation for Cryotanks			
Electrolytic Research Corp. LLC (Massachusetts)	Advanced Self-Heated Cell Reactor Using Large Scale Inert Anode for Molten Oxide Electrolysis			
Emergent Space Technologies Inc. (Maryland)	Marine Autonomous Surface Vehicle (ASV) Range Surveillance System			
Los Gatos Research (California)	Photonic Sensor for Non-Destructive Testing of Composite Overwrapped Pressure Vessels			
MARK Resources Inc. (California)	Tracking Launch Vehicles in Interference and Jamming			
Plasma Processes Inc. (Alabama)	High Surface Area Iridium Anodes and Melt Containers for Molten Oxide Electrolysis			
TDA Research Inc. (Colorado)	Low Toxicity Corrosion Inhibitors for Smart Coatings			
Xigen LLC (Maryland)	Novel Smart Pan/Tilt/Zoom Sensor for Launch Range Video Surveillance			
STTR				
CFD Research Corporation (Alabama) with the University of Florida	High-Fidelity Gas and Granular Flow Physics Models for Rocket Exhaust Interaction with Lunar Soil			
ZONA Technology Inc. (Arizona) with New Mexico State University	Multiscale GasKinetics/Particle (MGP) Simulation for Rocket Plume/Lunar Dust Interactions			

Partnerships

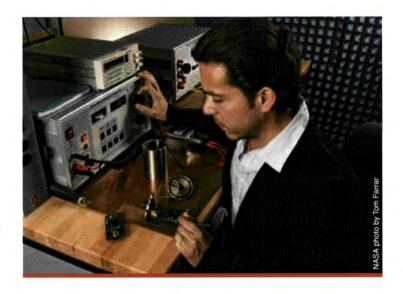
When IPP forms partnerships for collaborative research and development, everyone benefits—NASA, the partners, and the nation. Partnerships leverage technologies outside of Kennedy to benefit projects inside of Kennedy.

Spotlighting Successful Partnerships

Kennedy's Innovative Partnerships Program was pleased to facilitate 12 partnerships in 2009 and 2010. Previously signed partnerships also had significant achievements during this period. The two partnerships described here provide excellent examples of the value of collaborative R&D.

Infusion through Spin-Out, then Spin-Back

The Space Shuttle Program had a specific need for a voltage signal output from the hydrogen gas (H2) detectors for its launch processing system—a need not met by commercially available instruments. So Kennedy's Transducer Development and Electronics Labs developed a new circuit board that not only met this need but also could be applied to transmitter modules used with H2 detectors. When a supplier of H₂ detectors expressed interest in Kennedy's current-to-voltage board, IPP established a Technology Transfer Agreement. That supplier-Detector Electronics Corp.—has gone on to provide H₂ detectors back to Kennedy that met the voltage signal output and other requirements of the Space Shuttle Program.





Providing a Home for FAST Experiments

A partnership between Kennedy and Space Florida resulted in an adaptable, robust carrier for space experiments. Developed with funding from IPP, Space Florida, and NASA's Science Mission Directorate and research support from Bionetics Corp., FASTRACKTM enables investigators to test experiments, apparatus, and analytical techniques in hardware compatible with the International Space Station. The system also can be used to perform reduced-gravity science experiments as part of parabolic flight opportunities, such as the FAST program (see page 7). FASTRACK debuted in fiscal year 2009, carrying three science investigations on a

FAST flight. The carrier is now available for upcoming FAST flights.

FASTRACK is a trademark of the National Aeronautics and Space Administration.







Technology Transfer

Space program innovations can be used in many ways that benefit not only NASA but also the nation as a whole. Therefore, IPP makes Kennedy technologies available for non-aerospace use, creating a cleaner environment, healthier living, safer communities, efficient transportation, and more.

Marketing Kennedy Innovations

Technology transfer is a team effort that begins when the center's innovators submit new technology reports (NTRs) to IPP. Tapping into a network of market data, IPP reviews NTRs to identify their commercial potential. Staff also work closely with Kennedy's patent counsel to protect the intellectual property. For those innovations that show promise for the commercial sector, IPP markets the technology opportunity to potential licensees.

Publications

IPP publishes information about Kennedy technologies in several periodicals, including:

- NASA Tech Briefs, the monthly design engineering magazine that provides a unique and powerful way for industry to learn about Kennedy's and other NASA technologies. The 400,000 readers of NASA Tech Briefs learned of more than 30 Kennedy technologies submitted by IPP in 2009 and 2010. Visit http://www.techbriefs.com for more information.
- Spinoff, the annual periodical focusing on NASA's technology transfer successes. Kennedy's IPP contributed 11 articles to the 2009 and 2010 editions. Visit http://spinoff. nasa.gov for more information.
- Technology Innovation, published by IPP at NASA headquarters to provides information about NASA's technology needs and opportunities as well as interesting facts and feature articles about the agency's successes. Ten technologies and facilities affiliated with Kennedy were covered in 2009 and 2010.

Industry Outreach

In addition to targeted marketing, IPP attends various relevant industry conferences. For example, in March 2010, IPP personnel promoted various Kennedy technologies at Pittcon, the world's premier conference and

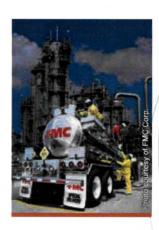


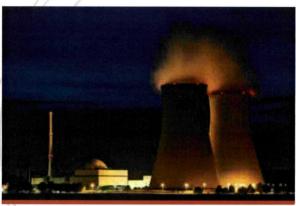
exposition on laboratory science. Companies expressed interest in Kennedy's spectrometer calibrator, hydrogen leak sensing tape, selfvalidating thermocouple, and the integral battery power limiting circuit. IPP also publishes articles in industry journals. For example, the cryogenics journal Cold Facts published an IPP staff paper in 2010 about Kennedy's development of a modular simulated rapid propellant loading system.

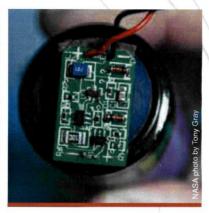
University Outreach

Not only are universities valuable sources of innovation and expertise that can be infused into NASA (see pages 4-10 for more about infusion), but they also can be users of space program technologies. Therefore, IPP is actively involved with the Association of University Technology Managers®. For example, at the 2009 AUTM Annual MeetingSM, IPP lead David Makufka served as moderator for a session discussing NASA technology transfer and partnership opportunities.

Association of University Technology Managers is a registered trademark and AUTM Annual Meeting is a service mark of the Association of University Technology Managers.







Signed Technology Transfer Agreements

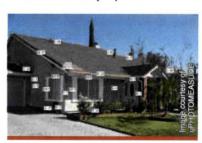
Kennedy's IPP facilitated the signing of multiple licenses and other agreements, enabling external organizations access to innovations with potential to benefit the U.S. citizenry and the economy.

Licenses and Other Agreements

Seven licenses were executed in fiscal years 2009 and 2010. Yet not all technology transfer successes are licenses. IPP approaches all transfer opportunities with a spirit of creativity and a desire to develop win-win arrangements.

Easier Photography Measurements

Originally developed to measure the size of debris in the vicinity of the shuttle orbiter as part of the Columbia accident investigation, Kennedy's 3D Scene Analysis Software now is making it easier for construction contractors to prepare estimates. This achievement is thanks to a copyright license to Digicontractor Corp., which pioneered the industry's first photo measuring software. By integrating Kennedy's software with its own line of uPHOTOMEASURETM software, the company now offers an enhanced product for instantly measuring



dimensions of a room or other site, eliminating the need for manual measurements. In addition to contractors and do-it-yourselfers, this license has benefits for appraisers, architects, insurance companies, plumbers, and more as well as law enforcement and even oceanographers.

uPHOTOMEASURE is a trademark of Digicontractor Corp.

Safer, Longer Lasting Instruments

Researchers at Kennedy developed an innovative circuit that limits the power output from a battery without compromising battery lifetime in situations where there is little headroom for dropping voltage or wasting current. The device prevents a spark emitted from a battery during a short circuit from possibly igniting volatile chemicals while not drawing much additional power in the process. Texas-based consulting firm Jerry West LLC has licensed the technology for use in instruments with extended battery life and an intrinsically safe configuration.

Cleaner Air

IPP facilitated the licensing of Kennedy's patented air pollution control technology to FMC Corp., a global company with leading positions in agricultural, industrial, and consumer markets. Kennedy's innovative technology removes nitric oxide gases emanating from manufacturing plants and other stationary combustion sources by injecting hydrogen peroxide into the gas stream. Doing so oxidizes the nitric oxide into a soluble form that can be subsequently removed from the gas stream. FMC expects Kennedy's technology to provide a simple, low-cost way for the U.S. power industry to comply with regulations that will be phased in over the next several years.







Better Tire Pressure Monitoring

To ensure the safety of shuttle orbiter landings, Kennedy engineers developed an innovative tire pressure monitor. This same technology has been transferred to Compucom Engineering, a provider of specialized function electronic assemblies. The company plans to create a commercial product based on Kennedy's innovation.

Greater Environmental Cleanup

Perhaps Kennedy's greatest licensing success story is its Emulsified Zero-Valent Iron (EZVI) technology, which originally was designed to help NASA deal with environmental cleanup of rocket fuels. This biodegradable technology uses iron particles in an environmentally friendly oil and water base to neutralize toxic chemicals. Developed collaboratively by researchers from Kennedy and the University of Central Florida, EZVI has been licensed nearly a dozen times. The most recent licensees are Florida-based Starlight Environmental Group and California-based A+ Environmental Solutions.

Safer PCB-Paint Cleanup

Because of their flame-resistant and insulating properties, PCBs were frequently added to paints used on buildings, ships, and other structures. However, scientists later found that PCBs cause cancer in animals and have other adverse effects for humans. As these paints began to deteriorate and chip off, new methods were needed to safely remove the PCB-laden paint. One innovative method—the Activated Metal Treatment System (AMTS)—was developed collaboratively by researchers at Kennedy and the University of Central Florida. The university researchers have formed a start-up called Scientific Specialists Inc., and IPP has established a Joint Ownership Agreement with the company. Under this agreement, Kennedy's IPP will take the lead in marketing the technology to potential licensees, and any royalties that result from licensing will be shared by the innovators as well as with IPP. A license



for AMTS was signed in 2010 with Toxicological & Environmental Associates Inc., which will create its own version of AMTS for pilot studies and customer projects.

Safer Nuclear Power Plants

A technology originally developed to increase the safety and reliability of NASA's space vehicle launch systems will be used at nuclear power plants to monitor the condition of electromechanical valves. Kennedy's smart current signature sensor proactively identifies failures and degradation of solenoid valves before they occur. IPP has licensed this innovation to Illinois-based Graftel Inc. Graftel plans to develop a handheld device to perform diagnostic testing on electromechanical valves used in nuclear power plants. The company expects that the application of Kennedy's technology to nuclear power plants will result in cost savings to the plants while at the same time increasing reliability and decreasing occupational dose of radiation to plant personnel.

Faster, Better Software

IPP executed four Software Usage Agreements (SUAs) in 2009 and 2010 to transfer innovations created by Kennedy's software developers to other agencies and industry. SUAs allow others to use a piece of software in a variety of situations. For example, depending on the stage of development and NASA mission-related goals, SUAs are used for beta-testing software; delivering software to partners who have existing grants, contracts, cooperative agreements, and Space Act Agreements with NASA; and transferring the software to other federal agencies, commercial entities, and academia.







Outreach and Awards

IPP's ability to succeed depends on the participation of Kennedy's innovators and the support of the general public. Therefore, IPP focuses on educating and inspiring others to share our commitment to technology transfer and infusion. Below are just a few examples of these efforts during 2009 and 2010.

Information

Kennedy's IPP helps others understand the value of technology transfer and infusion by various means.

Presentations to the Public

Presentations at non-aerospace events go a long way toward not only educating the public about the value of NASA programs but also inspiring the next generation of explorers and engineers.

For example, in 2009, IPP staff presented "NASA Brings Space Technology Down to Earth" at the *Jacksonville Home and Patio Show*, held 150 miles north of Kennedy's launch pads. Focusing on consumer products as well as health and medicine spinoffs, this presentation also dispelled some of the myths about NASA technology transfer successes—VELCRO®, Teflon®, and Tang® were all used by NASA but did not have the space program as their origin.

In 2010, representatives of IPP and Kennedy's biomedical engineering team spoke at the annual employee appreciation day at the *Moffitt Cancer Center and Research Institute*. In addition to being one of the country's leading cancer hospitals, the Tampa-based center employs more than 135 investigators that have been conducting a variety of scientific research since the early 1990s. Attendees were excited to hear about the many NASA spinoffs within and outside of the medical field as well as the biomedical research and technologies benefiting NASA's astronauts.

VELCRO is a registered trademark of Velcro Industries B.V. Teflon is a registered trademark of E. I. du Pont de Nemours and Company. Tang is a registered trademark of Kraft Foods Company

IPP's Web Site

In 2010, Kennedy's IPP redesigned its website to match NASA's overall online presence and to provide better access to information about IPP activities and program elements. A success stories section profiles the valuable contributions of Kennedy technology in commercial applications as well as how IPP-supported technology developments are benefiting NASA programs and projects.



Kennedy Tech Transfer News

IPP's semiannual magazine plays a key role in keeping Kennedy's innovators informed of their colleagues achievements in technology transfer and infusion. The issues published during 2009–2010:

- Profiled laboratories focusing on corrosion technology, applied physics, and electrostatics and surface physics
- Explained IPP's processes for technology marketing and licensing as well as partnership formation
- Educated innovators on the finer points of intellectual property (IP)
 management, including protecting IP in collaborations, copyrights,
 and data rights
- Recounted more than a dozen successes in licensing, infusion, and other IPP program elements







Innovator Recognition and Awards

IPP, in collaboration with NASA's Inventions and Contributions Board (ICB), recognizes the outstanding work of Kennedy's engineers, technicians, and scientists for innovative solutions to mission problems. IPP nominates Kennedy technologies for various awards from ICB as well as for awards from outside of NASA.

Non-NASA Awards

Recognition for Kennedy innovators is not limited to awards from within the agency. IPP frequently submits Kennedy technologies for various non-NASA awards. Some of these awards recognize not only the innovation itself but also its value in new applications. For example, IPP submitted the successful licensing of Kennedy's smart current signature sensor by Graftel Inc. (see page 13) to the southeast region of the Federal Laboratory Consortium for Technology Transfer, garnering an honorable mention.



Innovator Training

During 2009 and 2010, IPP hosted six training sessions for Kennedy innovators and management. These sessions focused on cutting-edge trends in innovation, the ins and outs of technology transfer, the value of outlicensing NASA technology and creating spinoffs, and IPP's various program elements.

NASA ICB Awards

For the past 50 years, the ICB has distributed millions of dollars for thousands of innovations that have enhanced the nation's space program and the quality of life for all U.S. citizens. The purpose of the awards is to provide an incentive for innovators by rewarding efforts to develop new technologies—including software—that advance NASA missions.

During the 2009-2010 period:

- More than \$105,000 in awards was given to more than 235 innovators for having their technologies published in NASA Tech Briefs, submitted to the U.S. Patent and Trademark Office for patent protection, or (in the case of software) released for use in non-development applications.
- More than \$120,000 was bestowed to more than 120 innovators as "Board Action Awards," honoring significant value contributed to NASA aeronautics or space activities.
- IPP submitted a software program used to analyze the likelihood of a lightning strike to any structure for NASA's Software of the Year Award.

To honor the achievements of Kennedy researchers, IPP hosted a luncheon in January 2009. The event included networking opportunities as well as a presentation by a successful licensee of Kennedy technology.

Contact Us

To learn more about the accomplishments summarized in this report, or to identify ways to participate in technology transfer and infusion at NASA's Kennedy Space Center, visit IPP online or call our offices today.

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